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## PLUMBING MATERIALS AND EQUIPMENT AS RELATED TO LOW-COST HOUSING

I. - General

Circular Letter 502, outlining the objectives, procedure and scope of the Bureau program of research on building materials with respect to their use in low-cost housing, enumerates plumbing as one of the elements of cost of housing to be included in the research. The plumbing system of a house, as usually defined, includes: the water supply and distributing pipes from a source of supply (usually the street water main); the plumbing fixtures, traps and fittings; the soil, waste and vent pipes within the house; and the house drain and house sewer from the soil and waste pipes in the house to a place of sewage disposal (usually the street sewer). Entirely aside from the variation in kind and cost of materials available for use in installing a plumbing system, the plumbing is probably more susceptible to variation in cost than any other single element of the house, because of the greater variation in quantity of material and the labor required to install a given unit of equipment. The costs of bringing in the water supply and carrying the drainage to the street sewer are almost entirely independent of the size and quality of the house. The costs of distributing the water supply to the units of equipment (bath room, kitchen sink, laundry trays, etc.) and of carrying the drains from these units to the house drain are also items of cost bearing no direct relation to the quality of the house.

In view of these facts, it appears that there is an opportunity for a considerable reduction in costs, entirely aside from the quality of materials employed, through a careful planning of the plumbing system by the architect, owner or builder, in respect to the location of the different units of equipment (bath rooms, etc.), the arrangement of the fixtures within a group as to compactness and a proper relation to bearing partitions and floor joists. The research in plumbing will be directed toward collecting the data needed for this planning and arranging these data in a form for use in such planning.

II. Present status of information

Although much of the planning suggested could be done on the basis of present information, full advantage of the opportunities for economy are not being taken. This is partly because the available data are not in a form to indicate clearly the minimum limits to which compactness of arrangement and minimum size of drains can be safely carried; partly because of differences in the specific requirements of the plumbing codes in different localities (states and cities) in some cases, and because of uneconomical and unnecessary requirements of the local code in other cases; and partly because the plumber is permitted to follow a local custom or use his own judgment regarding the arrangement and sizes of water and drain pipes installed, irrespective of the minimum requirements of the plumbing code applying or the actual needs as shown

by scientific data.

A considerable amount of experimental research was done at the Bureau in 1921 and 1922 in respect to the minimum requirements in plumbing for one and two-story dwellings. These data were utilized by the Subcommittee on Plumbing of the Department of Commerce Building Code Committee in formulating "Recommended Minimum Requirements for Plumbing."<sup>1</sup>

These Recommended Minimum Requirements for Plumbing have been adopted in entirety or in part by several states and a number of cities. Frequently however these particular recommendations most affecting simplicity and economy were modified or eliminated in favor of local practice or customs. The result therefore has been that, although on the surface a considerable progress toward uniformity of minimum requirements for plumbing seems to have been made, comparatively little improvement has been made in plumbing practices.

There are also other problems in plumbing that affect the cost of installation and concerning which various and conflicting local regulations are being adopted, for example health regulations pertaining to cross-connections in plumbing systems. It is extremely important from the standpoint of cost that the regulations applying to such matters should be as uniform throughout the country as possible. The Bureau has just completed an investigation of the technical and physical aspects of cross-connections, the results of which are soon to be published. It remains for the building and health authorities to formulate uniform regulations in respect to cross-connections before this project can be satisfactorily completed.

There are also two other recommended plumbing codes to which attention may be called; one sponsored by the National Association of Master Plumbers (1934); the other by the Pacific Coast Plumbing Inspectors Association (1935). So far as we are able to learn, neither of these codes has a background of research but in part they follow trade or local practices and in part follow "Recommended Minimum Requirements for Plumbing".

### III. Program of Research in Plumbing for Low-Cost Housing.

Aside from any incidental research on the quality or durability of materials that may be undertaken, the following subjects for study have been approved:

1. A study of plumbing piping layouts (water, drain and vent pipes) relative to the requirements for the efficient functioning of the system including the plumbing fixtures, and to the conservation of space, material, and labor.
2. A study of plumbing fixtures and flushing devices in relation to their adaptability to low-cost housing, including such items as serviceability, water supply requirements, drain pipe requirements, and characteristics relative to noise, back-siphonage, etc.

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<sup>1</sup>National Bureau of Standards, Elimination of Waste Series, BH-13 (1924) (revised 1929-1932.)

3. Compilation of the data from 1 and 2 in a form so as to clearly indicate and illustrate the most economical, serviceable layout with a given material.

4. Prevention of back-flow into water supply systems.

A. Specifications covering construction of system or devices required for the prevention of back-flow into water supply systems.

B. Development of a standard compliance test and test procedure for devices specified under (A).

